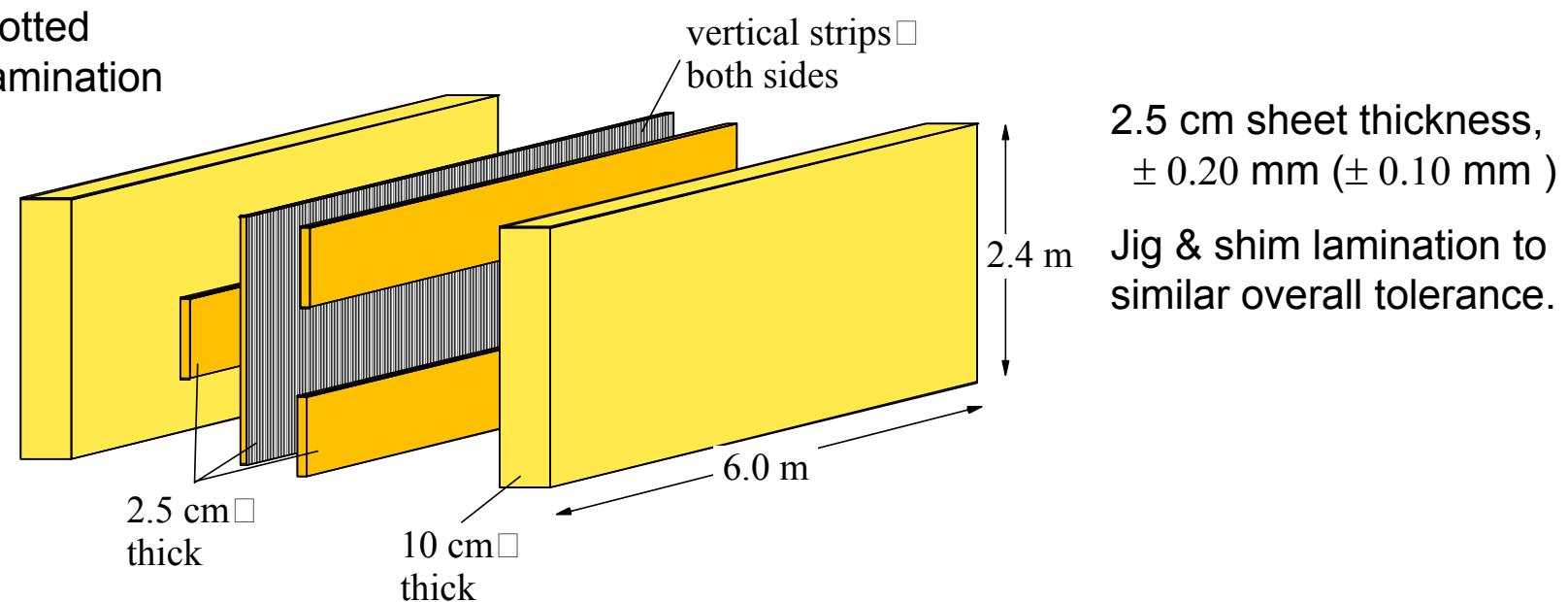


Monolithic absorber for RPC detectors

- Goals for monolithic absorber
 - ↗ Homogeneous calorimetry & tracking
 - ↗ Easy RPC insertion and removal
 - ↗ Minimize channel count, need to connect strips
 - ↗ Crane-less, low cost building
 - ↗ Permanent particleboard absorber (show video)
- John Cooper's questions for particleboard structures
 - ↗ Are there large structures built with particleboard?
 - ↗ How is a 20 m x 20 m x 150 m absorber assembled?
 - ↗ RPC panels:
 - How are RPC panels built and handled?
 - How are RPC panels inserted or removed from absorber?
 - Are absorber mechanical tolerances adequate?
 - How are signal, HV and gas connections made?
 - ↗ Climate control requirements for the building?

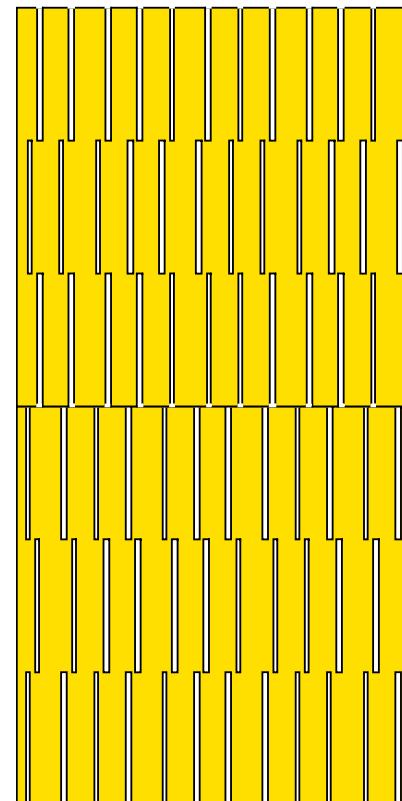
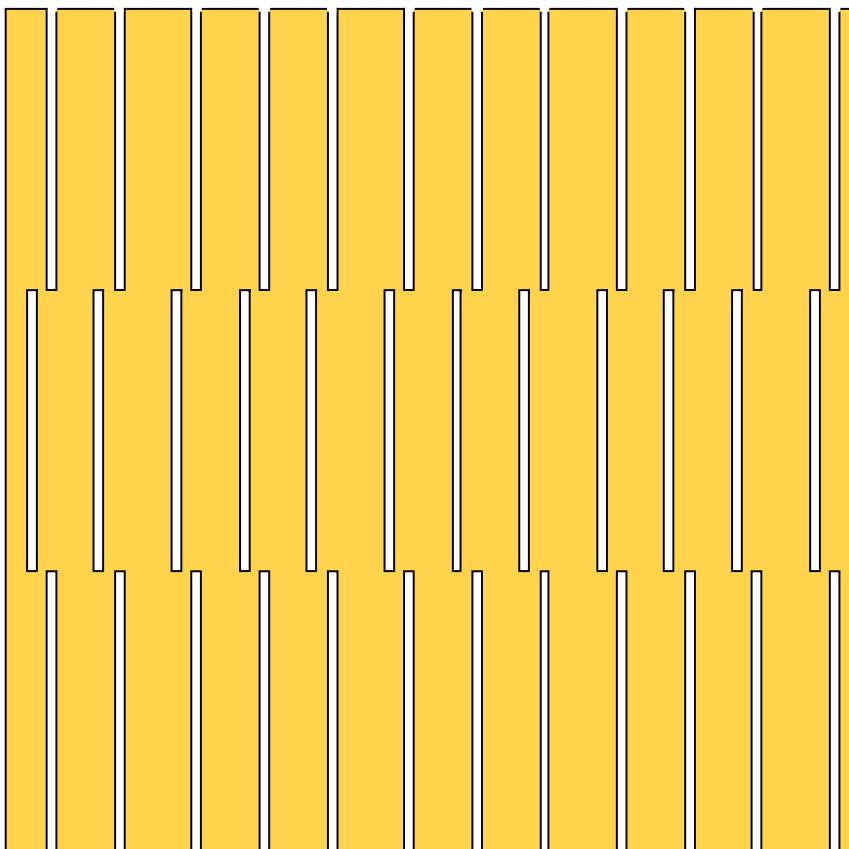
Particleboard Structures

- Are large structures built with particleboard?
 - ↗ YES! Modern multistory housing uses “engineered wood”. Example: I-beams “built-up” using OSB or particleboard are stronger, lighter, more accurate/stable, and cheaper than lumber beams.
 - ↗ Also, buildings are open box structures, while the calorimeter is nearly solid particleboard.
- How is a 20 m x 20 m x 150 m (50 kT) absorber assembled? How are vertical strips connected between modules?



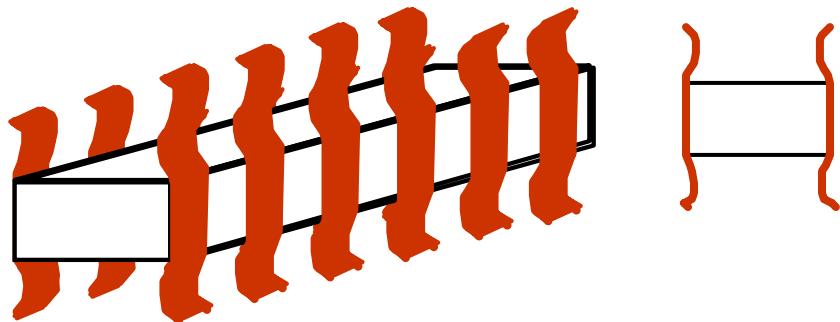
Particleboard Structure

- Twelve cell module 2.4 m x 2.4 m x 6 m
 - ↗ 86% particleboard, 14% slots.
 - ↗ Spacer overlap may be needed
 - ↗ Adjust lamination to ± 2.0 mm overall
- Stacking absorber modules
 - 8 high (19 m) and 3 wide (18 m).
 - ↗ Insure alignment with pins
 - ↗ Make vertical strips continuous

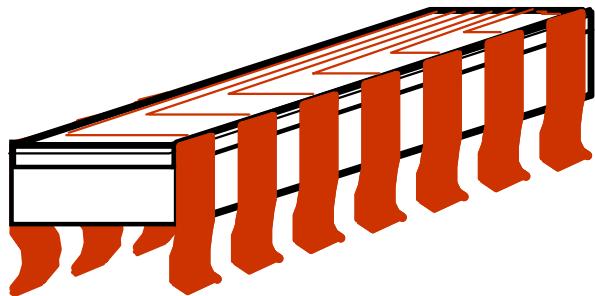


Vertical strip connections

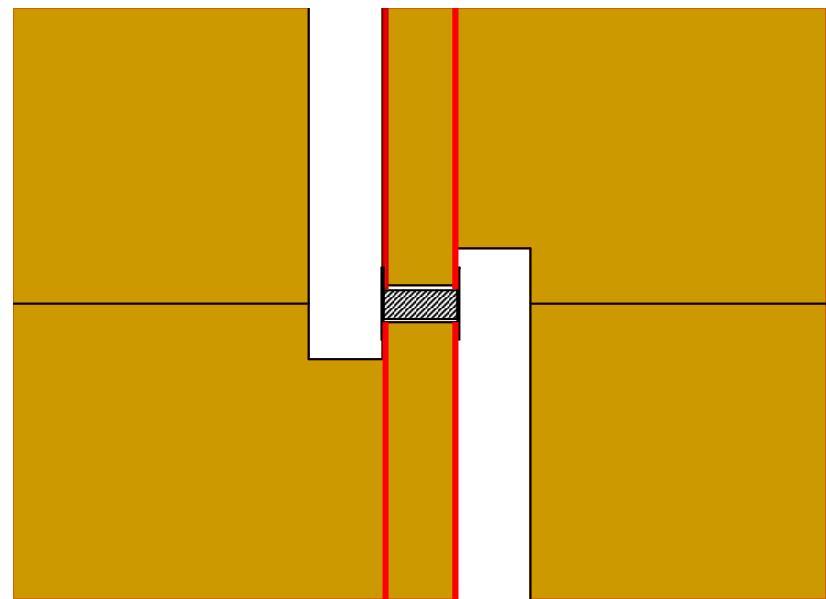
- Vertical strip connections are made with “card-edge” type connectors.



- Vertical strip connections to electronics or terminators use a similar connector.



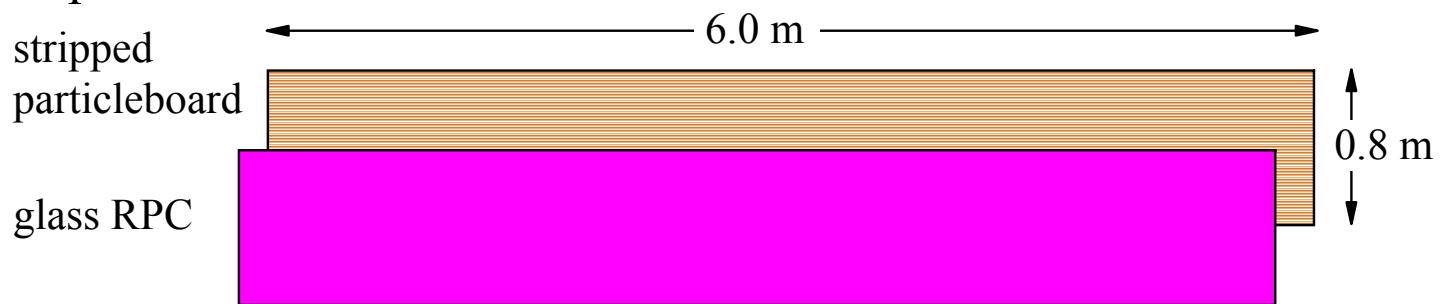
- Vertical strip connections made during stacking of absorber.
- Detail of joint between modules



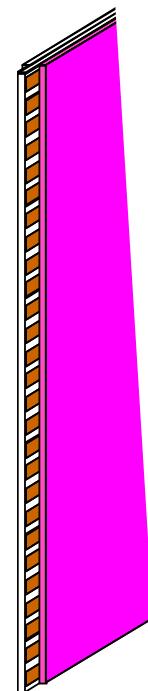
- Symmetric transmission line -- pulse polarity the same for left/right RPC.

RPC panels

- Horizontal strips

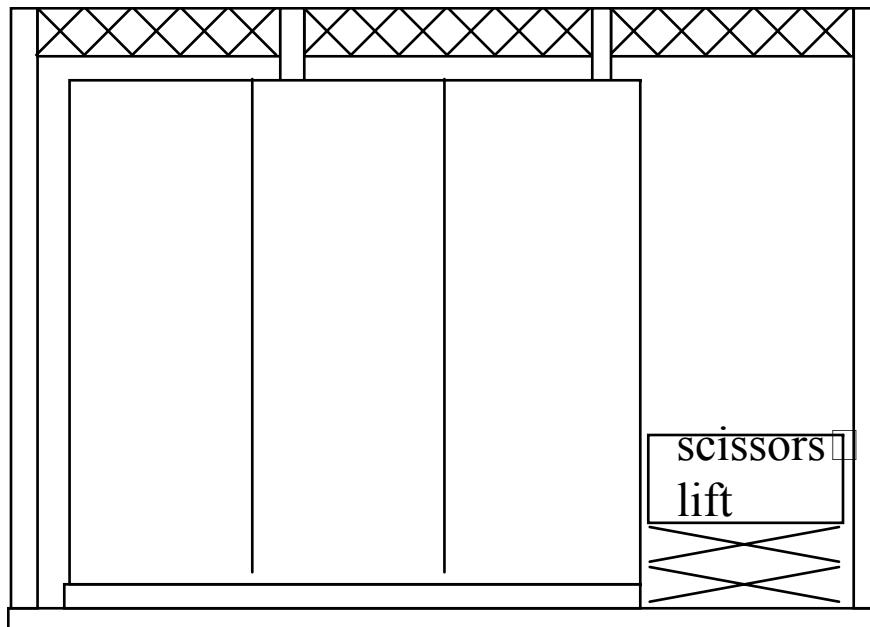


- RPC mounted on horizontal stripped particleboard. Panel weighs about 120 kg.
- Strips extend beyond the end of the RPC by 1-2 cm.
- “Card-edge” connectors join (lock) 3 RPC panels, as they are pushed (or pulled) sequentially down the absorber slots.
- 2 HV and 1 gas connection between RPC panels.
- Electronics located at one end, terminator at the other end.
- 1,240,000 channels total (< 20% of containerized)



Building Concept

- Absorber is permanent. Assemble with combination of rental crane, and lifting devices (large fork lift).
- Use a scissors lift to bring RPC modules to appropriate height.



- Environmental Controls
 - ↗ particleboard moisture content (nominal 8%) key to dimensional stability.
 - ↗ Relative Humidity 50 - 90% causes 0.8 % change in moisture content. 1% moisture content causes 1% thickness swelling
 - ↗ Very small surface area/volume implies a long time constant.
 - ↗ Best to coat exposed surfaces with solvent based sealant, to stabilize dimensions.
 - ↗ Use 6" high steel stands to keep particleboard off concrete floor.

Conclusions

- Alternating spacer/detector design yields a monolithic homogeneous structure with small inefficient regions.
- Particleboard absorber requires no framework, can be drilled, routed, sawed, screwed, glued, coated, etc., and is comparable in cost to any other absorber choice. Also, it may simplify the building and reduce its cost.
- Issues needing R&D:
 - ↗ Get prototypes of strips (Al or Cu) on particleboard.
This is applicable to containerized system as well.
 - ↗ Verify mechanical strength and stability of particleboard structure.
 - ↗ Verify ability to hold tolerances, allowing alignment of slots between modules. Critical for access.
 - ↗ Firm up costs of lamination and connectors.